Experiments in Store

Participatory Action Research with Women Farmers of Nepal

Catches of adult grain pests on suspended and ground traps varied according to the household's sanitation.

Astrid Bjoernsen Gurung [1]

Background

Rapid population growth and land degradation made food shortage a common phenomenon in many parts of rural Nepal. Exposed to annual monsoon rainfalls in summer and dry winters, farmers are highly dependent on seasonal production and grain storage. In 1956, first efforts to enhance food security in Nepal were initiated; these were targeted on imports of staple food and increasing of agricultural production. These efforts, however, failed to prevent the deterioration of the household food security, as marginal farmers lack access to markets and can not produce more on the depleted soils. A sustainable alternative to improve food security is the protection of the food already produced. Such strategy has gained attention more than twenty years ago. In a joint effort, FAO and His Majesty's Government of Nepal launched the Rural Save Grain Program (today Post-Harvest Loss Reduction Division). With the development and introduction of new techniques and simple equipment it aimed to reduce losses in the post-harvest system. In strong contrast to the success of similar programs in Central America (Schneider, 1997; Wright, 1986), the Nepalese program never made a breakthrough. What happened?

Dismantling the Technology Package

The metal bin was the most promising and persistently propagated technology. The bin should prevent the grain from getting moist and allow pest control with fumigants. This simple technology was so appealing that it ruled out the fact that hill farmers could not afford such an expensive technology; although it was suitable to their storage system. Lowland farmers, in contrast, possess the purchasing power but commonly store grain without prior sun-drying. Storing moist grain in air-tight containers again triggers the growth of fungal and insect pests. On this background, it does not surprise that both, hill and lowland farmers, widely rejected the metal bin but accepted the fumigation methods that were propagated along with the metal bin. Accepting only half of the technology package had consequences. The use of highly toxic fumigants like phosphine gas in permeable traditional storage structures states a health hazard to the farm-

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ers. Moreover, only sub-lethal gas concentrations are reached inside the vessel resulting in a build-up of insect resistance that, enforced by the increased pest susceptibility of modern varieties, again results in high on-farm storage losses. In short: the alleged solution triggered new pest problems.

Farmers' Storage School?

An alternative approach to technology transfer has been developed out of the experience with Integrated Pest Management (IPM) programs. The Farmer Field School (FFS) model is a participatory approach to agricultural extension (Kenmore, 1991; van de Fliert, 1993). In this model, farmers are not necessarily taught new technologies and knowledge but rather encouraged to develop their own capacity to think and innovate. In weekly meetings throughout an entire crop season, they meet with trainers to carry out field observations, analyze data, draw conclusions, and debate these conclusions. This approach has been successful in many countries. As grain storage is of minor importance in tropical countries, where the IPM FFS approach was developed, the issue of storage management has not been included in those programs. In subtropical countries like Nepal, however, there is a great need of addressing the post-harvest sector in such programs.

Participatory Action Research in Storage

With the objective to make local farmers benefit from the on-going field research on farmers' knowledge on storage pest management (Bjoernsen Gurung, 2002), Participatory Action Research (PAR) was conducted with local women farmers of Gobardiha, a Tharu village in Western Nepal. The women were guided in setting research priorities and in conducting their own experiments. The ultimate aim was to identify the source of the storage problems, i.e. to answer why problems occur, and to develop improved technologies acceptable to the farmer. The lessons drawn from this two-years' research partnership are the topic of this article.

Participation Against All Odds

The objective of the first years' survey taking place in seven Nepalese villages was to learn about farmers' perceptions of grain losses and their knowledge on storage pest management. Unless farmers perceive insect pests as a threat that is serious enough to justify action, launching pest control programs is useless. In this vein, these communities had to decide whether they want to participate in PAR. As a result PAR was conducted with a group of women farmers of Gobardiha that was most unsuitable from a logistical point of view. The village was remote, had no local partner organization, the illiterate women farmers had no prior contact to outsiders, and did not understand the Nepali language. Against all these odds, these fifteen farmers wanted to participate in the PAR.

Priority Setting

Priority was given to seed storage in wheat. Wheat has been recently introduced and complements rice and maize as main staple crops. Harvested on the onset of the rainy season, it is difficult to store during the subsequent hot and humid summer climate. To combat insect pests, farmers follow the strategy of over-consumption. Food grain is consumed as fast as possible and consequently results in a food scarcity. The underlying idea is that once the grain is consumed, insects can not compete with the farmer. For seed grain, however, this strategy does not work.

Water in the Grain

After two years of facilitating farmers' research and three years of studying farmers' knowledge and perception in storage management, I sometimes presumed to know how farmers think. The fact that I was still at the surface of their cognition became strikingly clear when the participants shared their most important insights drawn from the PAR during the final evaluation. I could not believe my ears when I heard one women saying: "For the first time, I realized that grain contains water, "a topic discussed during the mid-term meeting. Until that moment, it was entirely new to me that farmers might be ignorant about this fact that rationalizes and explains most of the practices that prolong the storability of grain.

Setting Future at Stake

Experimenting is one way of learning. Farmers experiment with great caution, in particular with the seed storage. For marginal farmers, seed is a carrier of hope and indispensable for the maintenance of the production cycle. If seed storage fails, nothing guarantees the timely availability of high quality seed of the desired variety. Therefore, it is important that farmers decide how much risk to take although this might conflict with the paradigm of scientific research. No rational farmer would intentionally put her grain at risk. The artificial inoculation of grain with insect pests, for instance, is unacceptable to local farmers although such experiments might be justified in scientific terms. Thus, to supplement the farmers' experiments with scientifically sound data, a set of on-farm experiments was conducted in the same village. The set-up of farmer-controlled and scientist-controlled experiments in the same site facilitated the information exchange and motivated the participants. The analysis of these two data types yielded in new sets of farmers' and on-farm experiments in the second year (Figure 1 and 2).

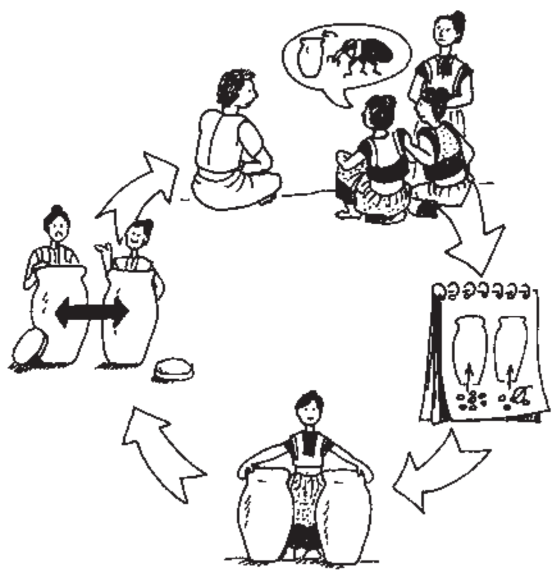


Figure 1. Visualized Action Research process used in the farmers' meeting.

Sorting Out Ideas

The participants' initial discussion on how to improve the local storage system reflected their concern for their household food security. They rejected ideas that (i) were entirely new and incomprehensible (e.g., mixing chaff with grain), (ii) involved monetary costs (e.g., recycled oil containers, incorporating metal sheets, pottery), (iii) required collaboration with others (organizing material from the market), and (iv) required equipment or time on a regular basis (e.g., temperature monitoring). They accepted ideas (i) they were familiar with (e.g., mixing botanicals), (ii) that were based on local practices (sand, smoking, plastering, incorporating foreign materials in bin wall), (iii) allowed independence, and (iv) promised immediate results that justify their action in the family. High labor costs were no reason for rejection (e.g., for sieving grain that was mixed with sand). Finally they decided on the following experiments:[2]

Experiment 1. Efficacy of Botanicals

Experiment 4. Insulation Capacity of Mud Bins

Experiment 5. Grain Moisture Content and Air Humidity

Experiment 6. Mustard Oil Cake

Experiment 9. Sun-drying

Experiment 10. Monitoring Nocturnal Insect Activity

Experiment 11. The Impact of Filling Temperature

Experiment 12. Fumigation with Phosphine Gas

Experimenting with Grain

The farmers experimented with seed storage in traditional vessels of 7-70 kg content. The vessels were made of clay and husk and sun-dried. After sealing, the containers were opened only after 7 months. The scientist experimented with similar vessels and gunny bags of 7 kg and 14 kg content.

[2] Only 4 experiments will be described in detail. If you are interested in all of them, please contact the author.

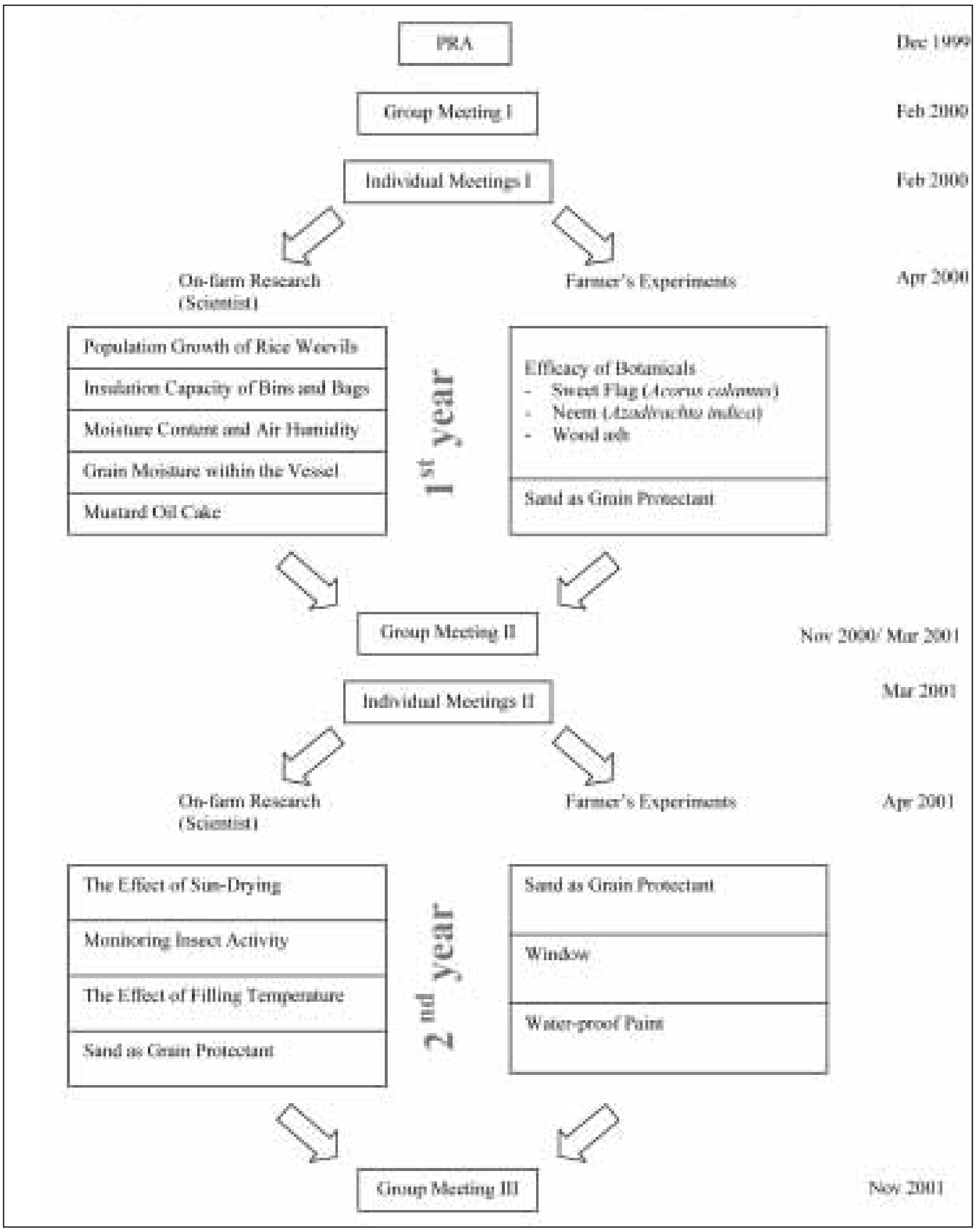


Figure 2. Two years' participatory Action Research in Gobardiha Village, Deukhuri-Dang, Western Nepal.

Experiment 2. Sand as Grain Protectant

Aim: Testing the efficacy of sand in controlling natural pest infestation.

Treatment: (i) Grain stored between two layers of 10 cm sand (farmers' experiment); (ii) Grain stored between two layers of sand, mixed with and stored without sand (scientist's experiment).

Results: Pests virtually absent in grain stored between layers. Untreated seed and seed mixed with sand was highly infested (Fig. 3).

Notes: Storing between sand layers has been an abandoned traditional practice. Only one participant experimented with sand in the first year. In the second year, the use of sand for pest control was re-adopted by almost all participants and many villagers.

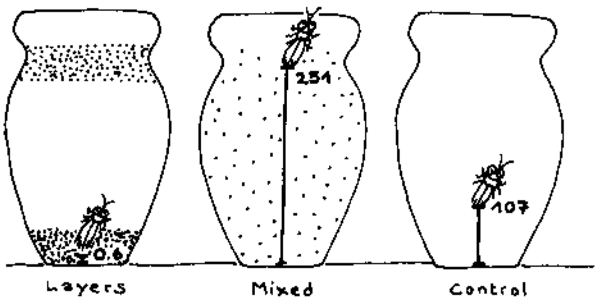


Figure 3. Average number of grain moths found in 500g samples retrieved from wheat stored within layers, mixed with or without sand.

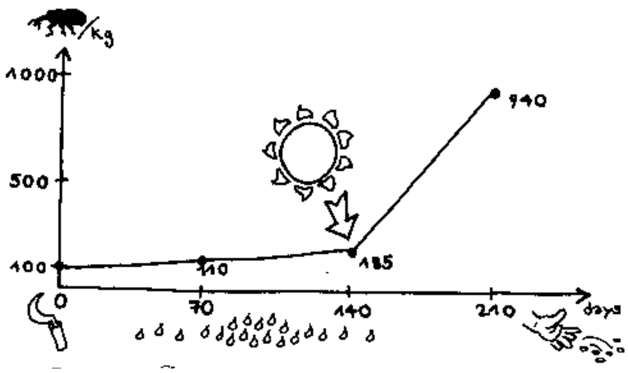


Figure 4. Weevil population growth in 1kg wheat samples.

Experiment 3. Population Growth of Rice Weevils

Aim: Testing the population growth of artificially inoculated rice weevils in bins and bags.

Treatment: Hundred Rice weevils were inserted in cotton bags containing 1 kg of wheat and placed in different grain depths. These insect populations were monitored after 70, 140, and 210 days.

Results: Independent of the vessel type, the weevil number remains tolerable until 140 days but increases 9-fold until the end of the storage period (Figure 4).

Notes: The results indicated that vessels should be opened after 140 days for sun-drying.

Experiment 7. Windows

Aim: Testing the suitability of windows to monitor insect activity.

Treatment: A piece of glass inserted at the foot of the bin wall where infestation is expected highest allows monitoring of the grain without opening. Once insects are detected, the grain is removed for repeated sun-drying (Figure 5).

Results: Highly acceptable and successful means. Except for one large (< 20 cm) and thin window pane, the windows remained intact and had no adverse effect on the container or the content.

Notes: No monetary costs involved.

Avoiding the Light

To share the results of the first year's on-farm research, the participants were invited for a meeting at 4 o'clock (expecting them to come at 5 o'clock). However, they did not come. We made a second walk through the village reminding the invitees. Still they did not come and I gradually saw the ethical pillars that supported my project collapse under their disinterest. How to let farmers participate in the on-farm research if they do not listen to you? How to give feed-back if they can not afford the time to join the meeting? How to justify further on-farm research if local farmers do not benefit from the results? These questions reeled in my mind when the meeting place remained empty. My frustrated assistant started blaming the farmers for their disinterest that was the root cause of their underdevelopment. My partner started to tell me that this is the irrefutable reality in the village. Frustration started spreading and the boulder on my breast was gaining weight. Worse than the desperate situation was my vanishing self-esteem. Did I misinterpret the women's reactions in former meetings? Did, what had appeared to me successful and full of joy and innovation, turn out to be just an imagination of my own wishing mind? Did the women participate because they felt forced or obliged to? How could I get such a false impression and walk home happily, in the belief to conduct real action research where farmers share the benefit?

I already started to make future project scenarios when the whole bunch of women farmers suddenly appeared, more than 1 1/2 hours late, but almost complete. The reason for their delay was their reluctance to walk through the village in bright day-light. They simply felt shy. We then had a wonderful and cheerful meeting.

Figure 5. Farmer with traditional (right) and improved (left) storage vessel.

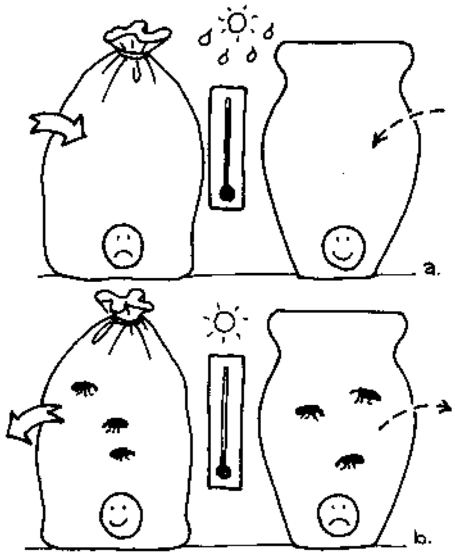
Experiment 8. Paint

Aim: Testing the feasibility, durability and efficacy of water-proof paint to maintain low grain moisture content levels.

Treatment: Painting the clay bin with water-proof paint from outside to make it air-tight.

Results: The increase in grain moisture was smaller in painted bins than in non-painted bins (about 1%) but was also influenced by insect respiration inside the bin (Figure 8).

Notes: Air-tight vessels are an option for well-dried seed grain. The recommendation of the extension service of incorporating a plastic sheet in the bin is not practicable; it is impossible to construct such bins. Storing grain in plastic bags inside the rodent-proof bin is neither a sustainable solution. Plastic needs to be purchased and is not durable. Painting the vessel with paint involves monetary costs but is more durable than plastic. To avoid inside condensation, the bins were painted from outside only. The custom of re-plastering the bins during the Dasain festival in October adds moisture and hence affects the grain storability in non-painted bins.



(a) Cool grain stays longer cool in bins than in bags; (b) The heat from insect respiration is neutralized faster in bags than in bins.

A Bin with a View

From the first year's on-farm experiments it was clear that storage bins should be opened and checked after 140 days of storage, i.e. right after the end of the rainy season. Drying the commodity at this time, would preserve the seed until the end of the storage period (210 days). However, although this scientific finding had been visualized and explained to the farmers, they did not follow the recommendation. There is a widespread belief that the opening of vessels is harmful, as the entering air triggers pest infestation and spoilage. The belief is stronger than scientific facts. Thus, most of the bins remained sealed for the entire storage period.

How to monitor the commodity without opening the bin? With a window. A piece of glass inserted at the foot of the bin allowed monitoring from outside. Once insects were detected, the farmers did not hesitate to remove the grain for sun-drying. If no insect activity was observed, opening was unnecessary. This "improved bin with a view" was highly successful and acceptable. Windows are now also incorporated in larger vessels containing food grain.

Women's Voices: Not Loud But Effective

The frame condition in which technology development takes place is important for the dissemination and acceptance of a new idea. Although not more than 15 women participated in the PAR, the activities influenced the storage practices of the entire village. This became strikingly clear during the search for households using aluminium phosphide for grain fumigation. As almost 30 % of the households use fumigation tablets, it was easy to find households willing to volunteer in a later phosphine gas measurement and risk assessment. This was the case when we started our activities. Only a few months later, however, none of the volunteers was available for measurement and so was the majority of the village. What has led to such a dramatic change?

Although the village counts more than 150 households, the findings of the women's experiments and the consecutive discussions were shared with the families and spread throughout the village. In particular, the idea if using sand as a grain protectant found wide acceptance as it coincided with other factors favoring a change in farmers' pest control practices: (i) Aluminium phosphide lost popularity, as the build-up of pesticide resistance has been observed and the product blamed for reducing the germination power; (ii) the local shop keeper stopped selling the fumigation tablets after hearing about the women's group experimenting with alternative methods; and (iii) along with the warning, farmers got a feasible alternative they were familiar with (sand).

Lessons Learnt

The PAR with women farmers showed that they are well aware of storage losses and able to acquire and use skills of setting up and analyzing experiments. Given some guidance, they are able to solve storage-related problems and to improve their storage systems. A few points should be kept in mind:

(1) Science and Common Sense

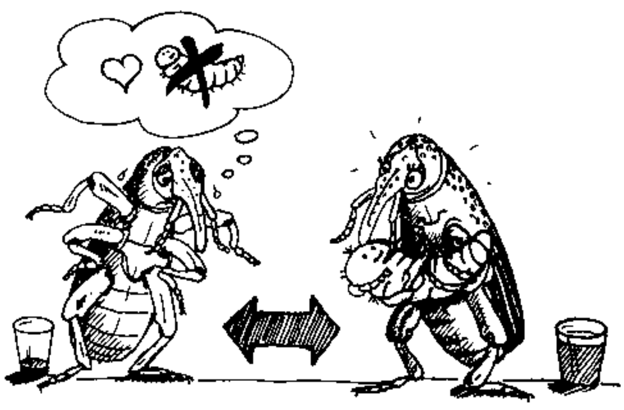
The scientific research approach of comparing two storage systems that differed by only one factor was illogical to farmers. As farmers need the benefit rather than the proof, it is incomprehensible to them that a part of the grain remains untreated although there is a control method that stands a chance of success. In the same vein, farmers felt uneasy to use two vessels of similar seize leaving half of the grain untreated. Hence, about half of the participants decided to make the control vessels very small to minimize the expected loss in untreated seed.

(2) Flexibility

Experimenting with farmers in storage management requires highest flexibility from the part of the facilitator. Storage activities are not planned but are often performed when there is opportunity. Times, varieties, structures and practices are highly individual so that group work needs to be complemented by individual visits and guidance.

(3) Data gaps

The time span between setting up and analyzing experiments is long. Consequently, there is a high chance of missing some relevant data rendering the data base unsuitable for scientific purpose. Experiments can be terminated, for instance, if the family requires the grain for food. The problem of data gaps can be solved by loss assessment methods that are independent from samples. In our case, farmers ranked the grain quality in 4 levels: (i) Edible for humans; (ii) Used for the production of beer and alcoholic spirits; (iii) Used as pig feed; and (iv) discarded.



Insect reproduction is highly dependent on the availability of water.

(4) Individual and Group Work

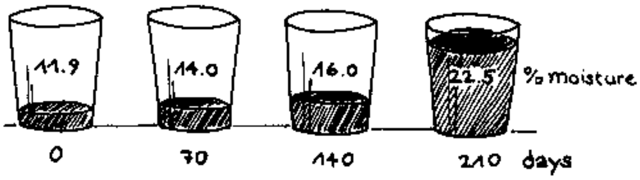
Group work is indispensable for the motivation/ encouragement of the participants and the exchange of information. Many of the farmers' experiments would t have been conducted without the knowledge that others are also doing so. In contrast, farmers would not agree to conduct experiments together or to use methods rendering them dependent on others.

(5) The Need of Scientific Experiments

As a consequence the practices in storage management are as diverse as the people. If scientific data is needed, scientist-controlled experiments are indispensable.

(6) Reliable Technology Disseminates Itself

Reliable, acceptable and affordable technologies can spread without any external initiative. The method of storing grain between sand layers, for instance, was found effective to control storage pests, and consequently was re-adopted by most villagers.



Increase of grain moisture content over a 210 days storage period.

References

Björnsen Gurung, A. (2002). Indigenous knowledge of storage pest management in Nepal. PhD, Swiss Federal Institute of Technology, Zurich.

Kenmore, P. (1991). How rice farmers clean up the environment, conserve biodiversity, raise more food, make higher profits. Indonesia's IPM – A model for Asia. Manila, Philippines: FAO.

Schneider, K. (1997). Everybody gets a grain silo: POST-COSECHA in Central America. Lindau, Switzerland: Swiss Center for Agricultural Extension, Lindau.

van de Fliert, E. (1993). Integrated Pest Management: Farmer Field Schools generate suitable practices. Wageningen Agricultural University Paper 93-3. WAU, The Netherlands.

Wright, V. (1986). "Use of pesticides for insect control in farm storage," in B. R. Champ and E. Heighley (eds.), Proceedings of an International Seminar on Pesticides and Humid Tropical Grain Systems No. 14. Manila, Philippines, 27-30 May 1985 (pp. 335-342). ACIAR.